Specification for Approval

PRODUCT NAME:

PRODUCT NO.: P M O 8 4 0 1

CUSTOMER
APPROVED BY
DATE:

PACER PLC	APPROVED

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REVISION RECORD

REV.	REVISION DESCRIPTION	REV. DATE	REMARK
X01	INITIAL RELEASE	2003. 09. 04	
X02	■ Modify Voltage & Current ■ Modify CIE Specification ■ Add Application circuit & DC-DC circuit	2003. 11. 28	Page 5, 6, 8 & 9
A01	FORMAL RELEASE	2004. 02. 24	
A02	■ Modify CIE Specification ■ Modify OQC Specification Criteria ■ Append Packaging Specification ■ Addend the AQL Definition of External Appearance Defect	2004. 05. 10	Page 7,19, 20,21,22
A03	■ Modify Panel Electrical Specifications ■ Modify Reliability Test Conditions ■ Remove the outgoing inspection provision (Refer to “OQC SPEC – STD – Mono, Area”)	2005. 04. 21	Page 7, 15 & 21

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1. SCOPE

This specification is to define the general provisions and quality requirements that apply to the supply of display cells manufactured by Pacer. This document, together with the Module Ass'y Drawing, is the highest-level specification for this product.

2. FEATURES

- Two Area color small molecular organic light emission diode
- Color: Blue/Yellow
- Panel matrix: 128*64
- Driver IC: SSD1303
- Excellent quick response time.
- Extremely thin thickness for best mechanism design: 2.05mm
- High contrast. 100:1
- Wide viewing angle. 160□
- 8-bit 6800-series parallel interface, 8-bit 8080-series parallel interface, serial peripheral
- Wide range of operating temperature : -20 to 70 °C

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3. MECHANICAL DATA

NO	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	128 (W) x 64 (H)	dot
2	Dot Size	0.18 (W) x 0.21 (H)	mm^2
3	Dot Pitch	0.20 (W) x 0.23 (H)	mm^2
4	Aperture Rate	82	%
5	Active Area	25.58 (W) x 15.18 (H)	mm^2
6	Panel Size	33.0 (W) x 23.0 (H)	mm^2
7	Panel Thickness	2.05 □ 0.1	mm
8	Module Size	33.0 (W) x 37.5 (H) x 2.05 (T)	mm^3
9	Diagonal A/A size	1.2	inch
10	Module Weight	3.0 □ 10%	gram

4. MAXIMUM RATINGS

ITEM	MIN	MAX	UNIT	Condition
Supply Voltage (V_{DD})	-0.3	3.5	V	Ta = 25°C
Supply Voltage(Vcc)	8	16	V	Ta = 25°C
Operating Temp.	-20	70	°C	
Storage Temp	-40	85	°C	
Humidity	-	85	%	
Operating Life Time	8,000	-	Hrs	30cd/m2, 20% pixels scrolling display on at 85Hz frame
Storage Life Time	20,000	-	Hrs	Ta=25°C, 50% RH

Note:

(A) Under Vcc = 12 Volts, Ta = 25°C, 50% RH.

(B) Operating Life Time is defined when the luminance has decayed to less than 50% of the initial measured luminance before life test.

(C) The storage life time is define as 25% dimension shrinking of initial value and luminance □ minimum luminance under temperature □ 25°C, RH<50%,

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5. ELECTRICAL CHARACTERISTICS

5.1 D.C ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETERS	TEST CONDITION	MIN	TYP	MAX	UNIT
V_{CC}	Analog power supply (for OLED panel)	Ta=-20 □C to	11.5	12	12.5	V
V_{DD}	Digital power supply	Ta=-20 □C to	2.4	2.7	3.5	V
I_{DD}	Operating current for V_{DD} V_{DD} = 2.7V, V_{CC} = 12V, IREF = 10uA No loading, All Display ON	Contrast=FF	-	190	-	uA
I_{CC}	Operating current for V_{CC} V_{DD} = 2.7V, V_{CC} = 12V, IREF = 10uA All Display ON	Contrast=FF	-	550	-	uA
V_{IH}	Hi logic input level		0.8* V_{DD}	-	V_{DD}	V
V_{IL}	Low logic input level		0	-	0.2* V_{DD}	V
V_{OH}	Hi logic output level		0.9* V_{DD}	-	V_{DD}	V
V_{OL}	Low logic output level		0	-	0.1* V_{DD}	V
I_{SEG}	Segment on output current V_{DD}=2.7V, V_{CC}=12V, IREF=10uA, Display on, Segment pin under test is connected with a 20K resistive load to V_{SS}	Contrast=FF	-	-	300	uA
		Contrast=AF	-	220	-	uA
		Contrast=5F	-	120	-	uA
		Contrast=0F	-	20	-	uA

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5.2 ELECTRO-OPTICAL CHARACTERISTICS

PANEL ELECTRICAL SPECIFICATIONS

PARAMETER	MIN	TYP.	MAX	UNITS	COMMENTS
Normal mode current	-	7	9	mA	All pixels on (1)
Standby mode current		1	2	mA	Standby mode 10% pixels on (2)
Normal mode power consumption	-	84	108	mW	All pixels on (1)
Standby mode power consumption		12	24	mW	Standby mode 10% pixels on (2)
Normal Luminance	40	45		cd/m^2	Display Average
Standby Luminance		10		cd/m^2	Display Average
CIEx(Blue)	0.12	0.15	0.18		x, y (CIE 1931)
CIEy(Blue)	0.22	0.27	0.32		
CIEx(Yellow)	0.42	0.46	0.50		x, y (CIE 1931)
CIEy(Yellow)	0.46	0.50	0.54		
Dark Room Contrast	100:1				
Viewing Angle	160			degree	
Response Time		10		μs	

(1) Normal mode condition :

- Driving Voltage : 12V
- Contrast setting : 0x4F
- Frame rate : 85Hz
- Duty setting : 1/64

(2) Standby mode condition :

- Driving Voltage : 12V
- Contrast setting : 0x0C
- Frame rate : 85Hz
- Duty setting : 1/64

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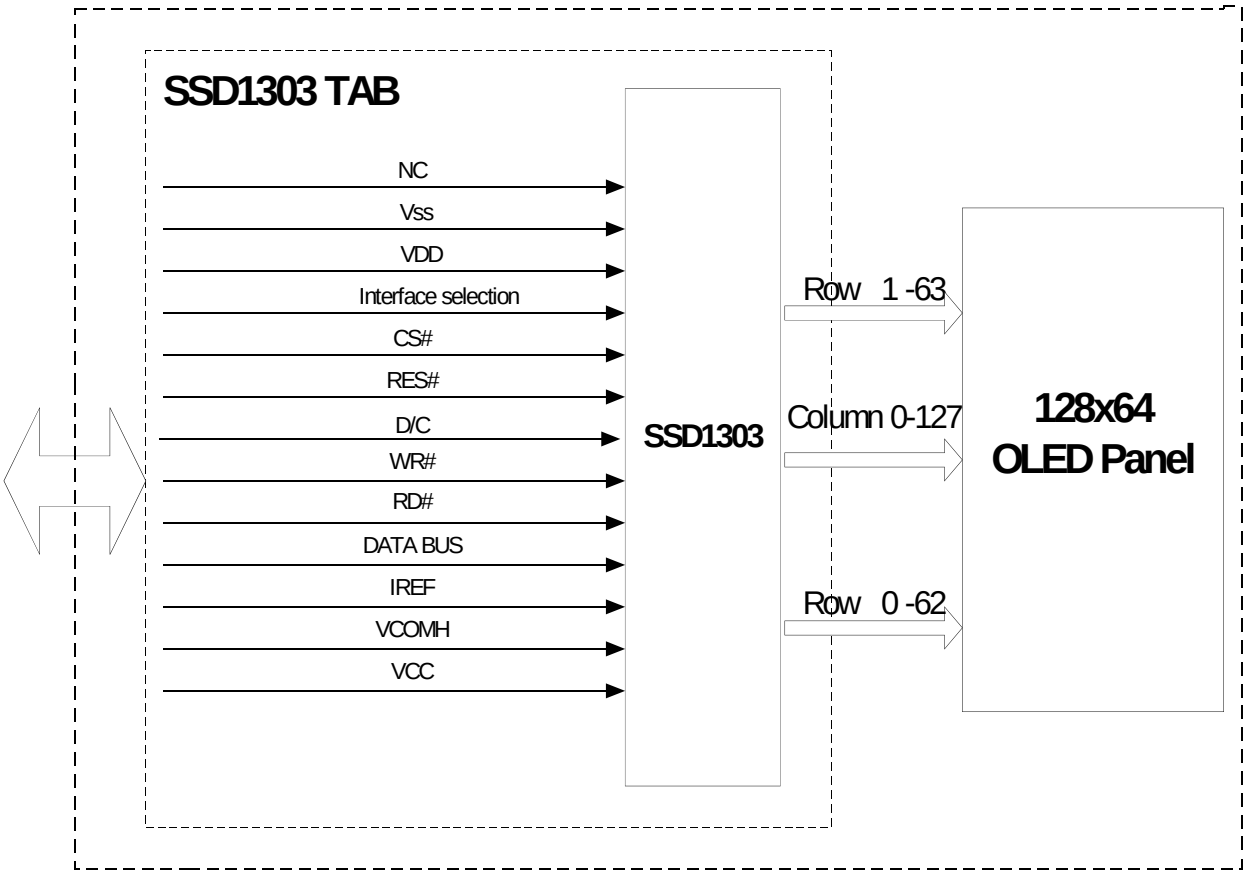
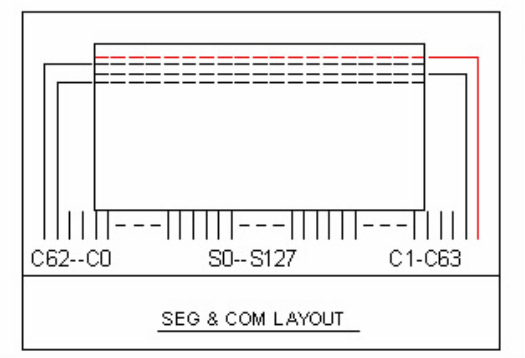
6. INTERFACE

6.1 FUNCTION BLOCK DIAGRAM



Pacer 128X64 OLED Module

6.2 PANEL LAYOUT DIAGRAM



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6.3 PIN ASSIGNMENTS

PIN NAME	PIN NO.	TYPE	DESCRIPTION
NC	1	-	No connection
V_{SS}	2	I	This is a ground pin.
Test 0	3	-	Reserved pin; No connection and left float
Test 1	4	-	Reserved pin; No connection and left float
Test 2	5	-	Reserved pin; No connection and left float
Test 3	6	-	Reserved pin; No connection and left float
Test 4	7	-	Reserved pin; No connection and left float
NC	8	-	No connection
NC	9	-	No connection
NC	10	-	No connection
V_{DD}	11	I	Voltage power supply for logic
BS1	12	I	MCU interface selection input
BS2	13	I	MCU interface selection input
NC	14	-	No connection
CS#	15	I	This is a chip select control pin.
RES#	16	I	Hardware reset signal
D/C#	17	I	This is a Data/Command control pin.
WR#	18	I	This pin is used to receive the Write Data signal.
RD#	19	I	This pin is used to receive the Read Data signal.
D0	20	I/O	This pin is bi-direction data signal
D1	21	I/O	This pin is bi-direction data signal
D2	22	I/O	This pin is bi-direction data signal
D3	23	I/O	This pin is bi-direction data signal
D4	24	I/O	This pin is bi-direction data signal
D5	25	I/O	This pin is bi-direction data signal
D6	26	I/O	This pin is bi-direction data signal
D7	27	I/O	This pin is bi-direction data signal
I_{REF}	28	I	A resistor should be connected between this pin and V_{SS}
V_{COMH}	29	I	A capacitor should be connect between this pin and V_{SS}
V_{CC}	30	I	Positive high voltage power supply
NC	31	-	No connection

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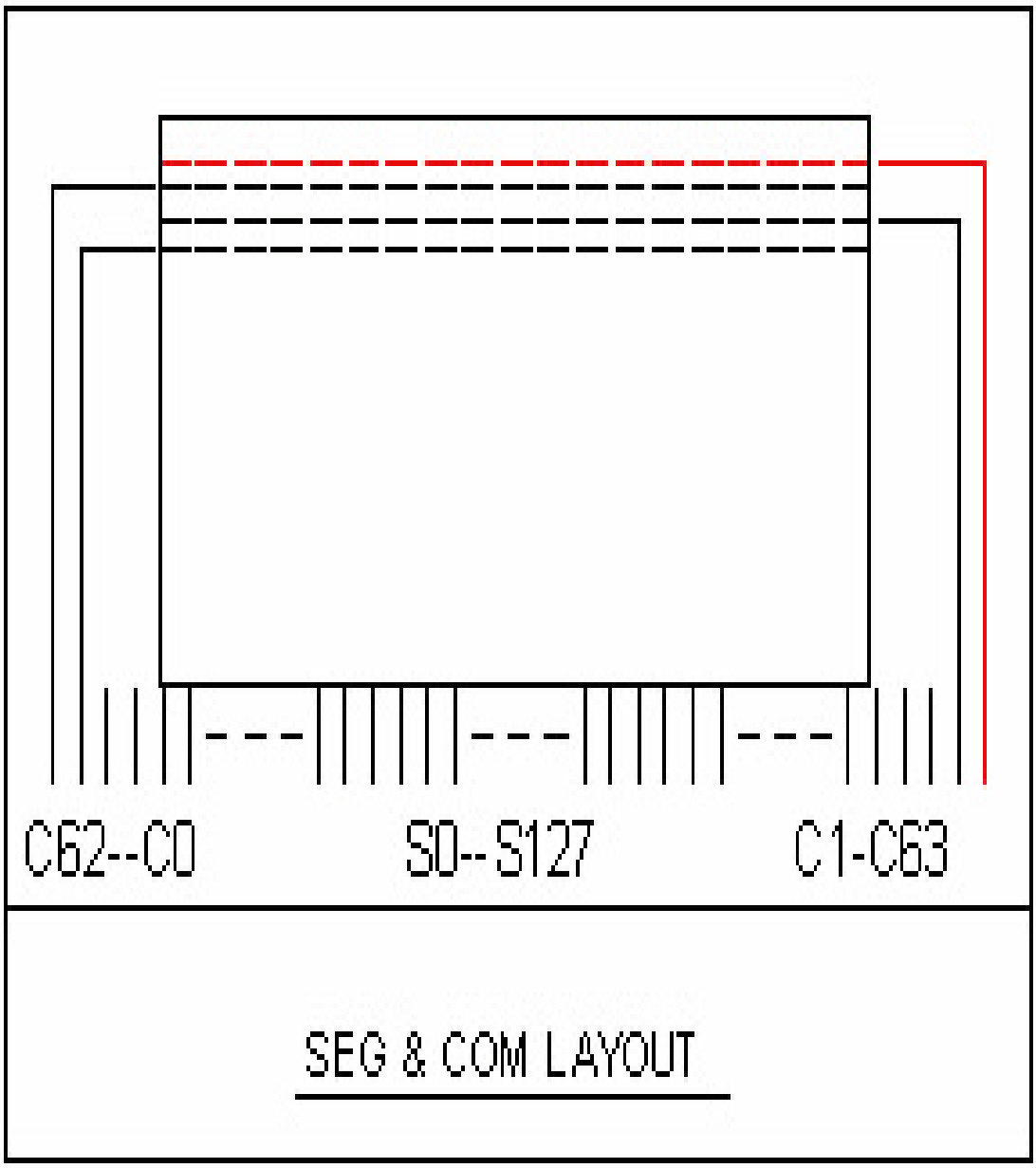
6.4 GRAPHIC DISPLAY DATA RAM ADDRESS MAP



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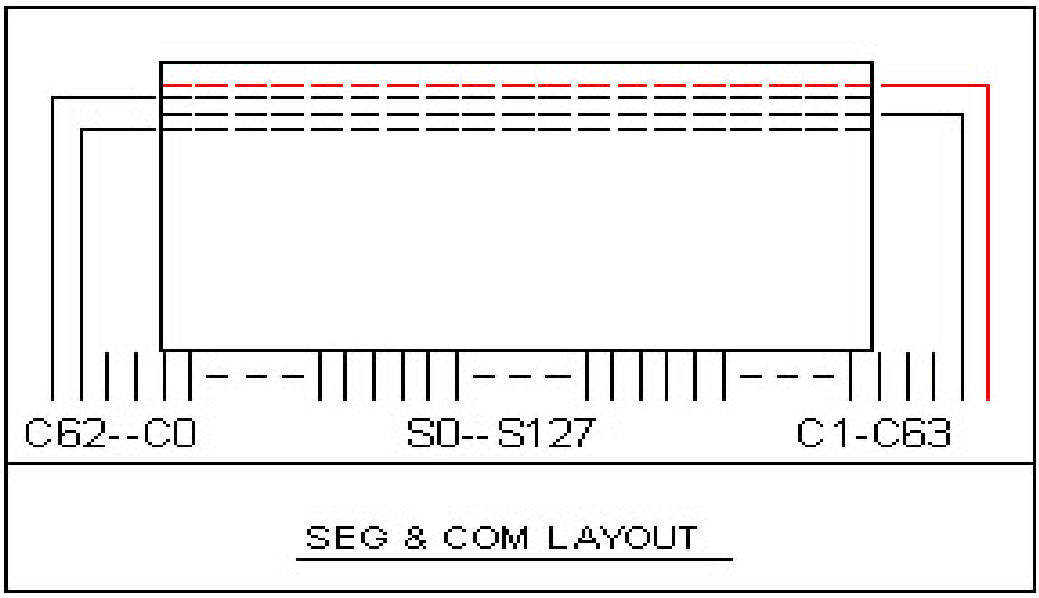
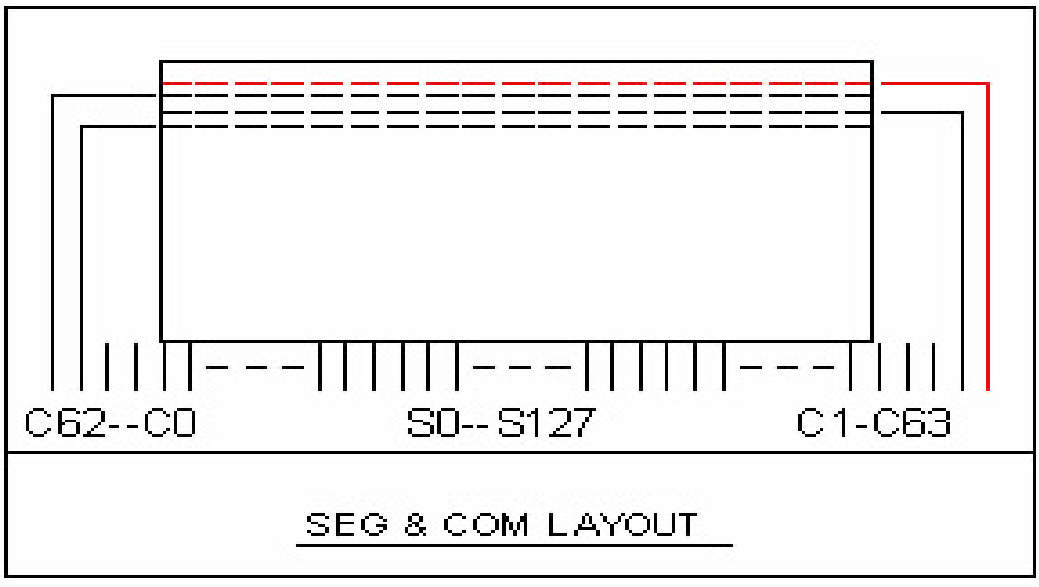
6.5 INTERFACE TIMING CHART





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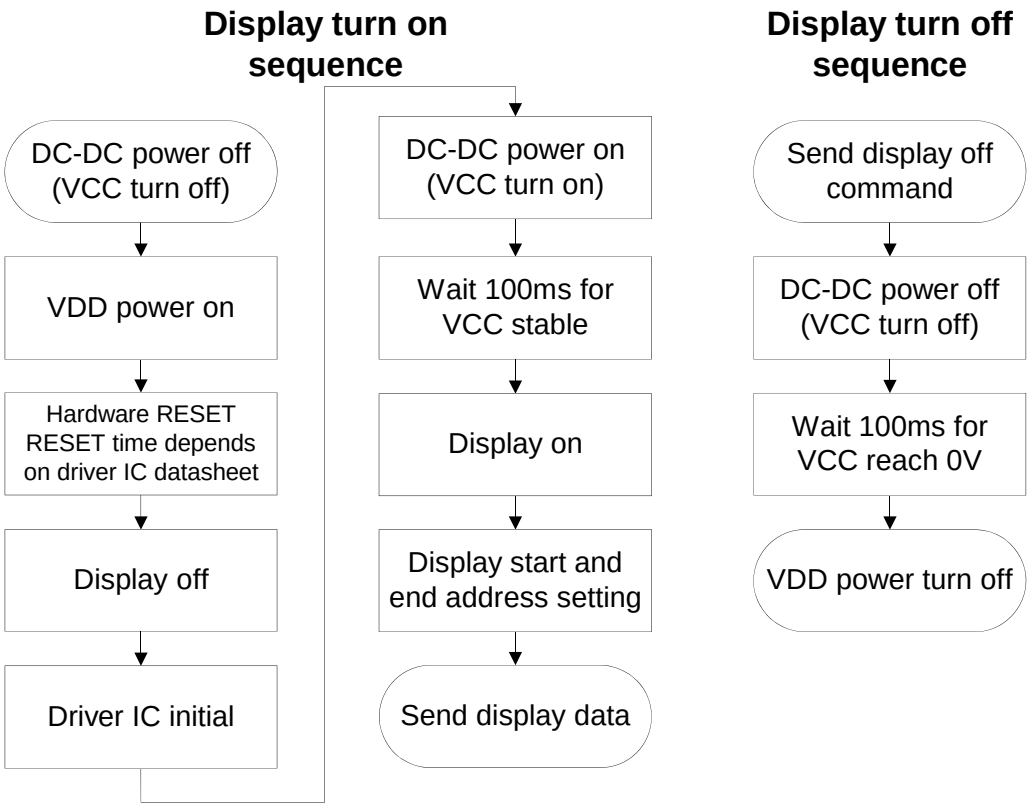
7. POWER ON / OFF SEQUENCE & APPLICATION CIRCUIT

7.1 POWER ON / OFF SEQUENCE


Display turn on sequence
DC-DC power off (VCC turn off)
VDD power on
Hardware RESET
RESET time depends on driver IC datasheet
Display off
Driver IC initial
DC-DC power on (VCC turn on)
Wait 100ms for VCC stable
Display on
Display start and end address setting
Send display data
Display turn off sequence
Send display off command
DC-DC power off (VCC turn off)
Wait 100ms for VCC reach 0V
VDD power turn off

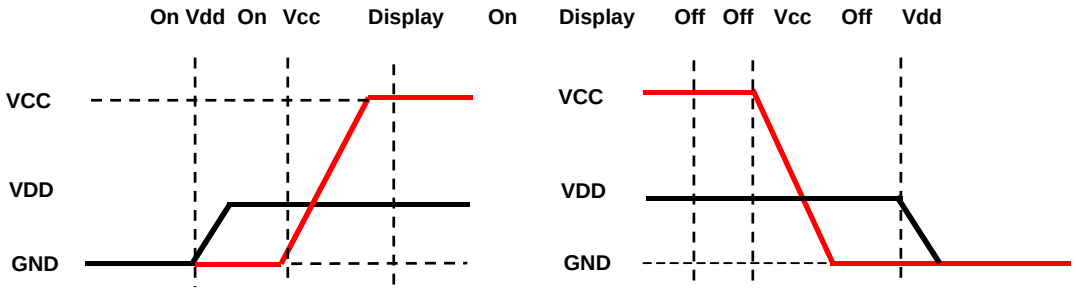
To protect OLED panel and extend the panel lifetime, the driver IC power up/down routine should include a delay period between high voltage and low voltage power sources turn on/off.

Power up Sequence:

1. **Power up Vdd**
2. **Hardware RESET**
3. **Send display off command**
4. **Power up Vcc**
5. **Delay 100ms (when Vcc is stable)**
6. **Send Display on command**

Power down Sequence:

1. **Send Display off command**
2. **Power down Vcc**
3. **Delay 100ms (When Vcc is reach 0 and panel is completely discharges)**
4. **Power down Vdd**



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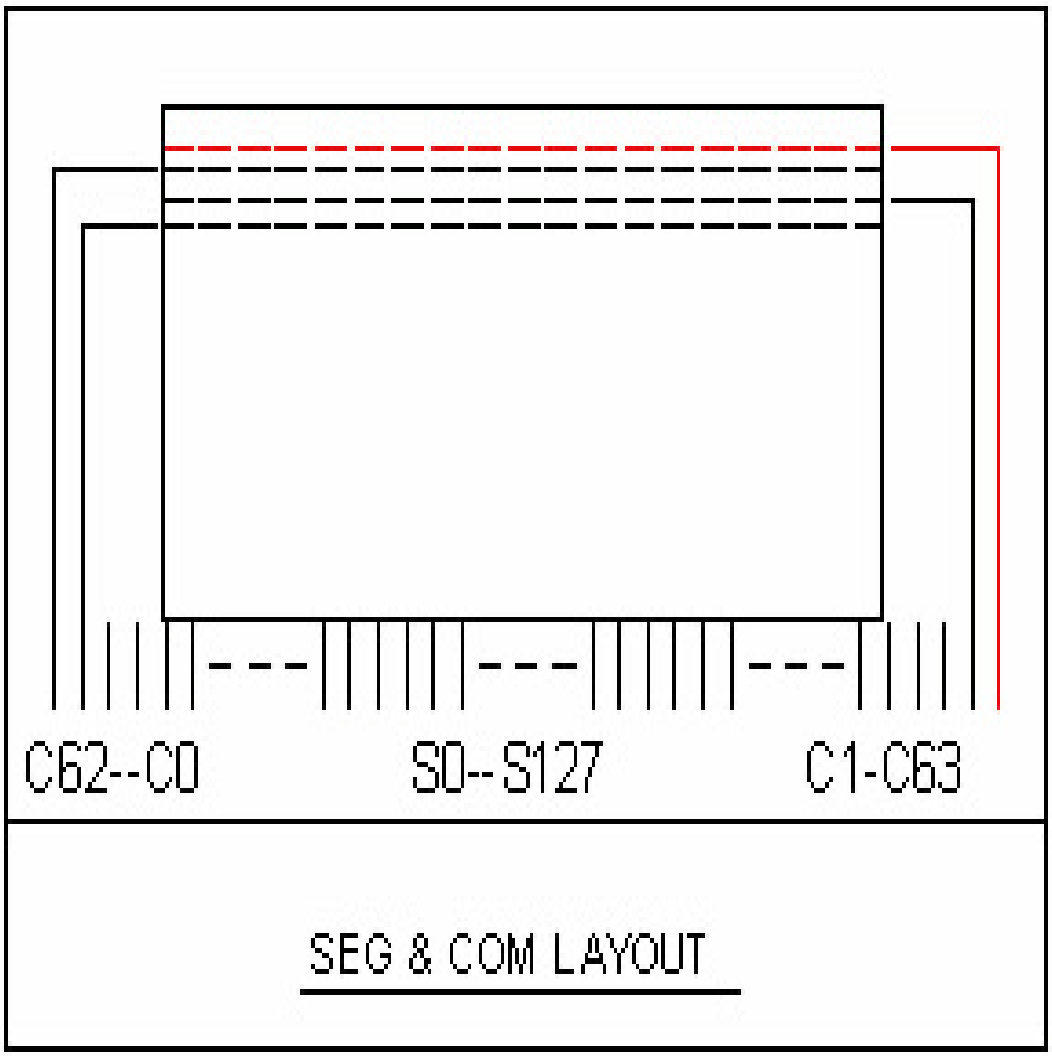
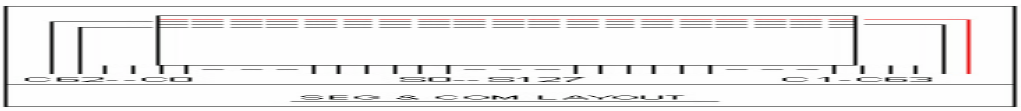
7.2 APPLICATION CIRCUIT





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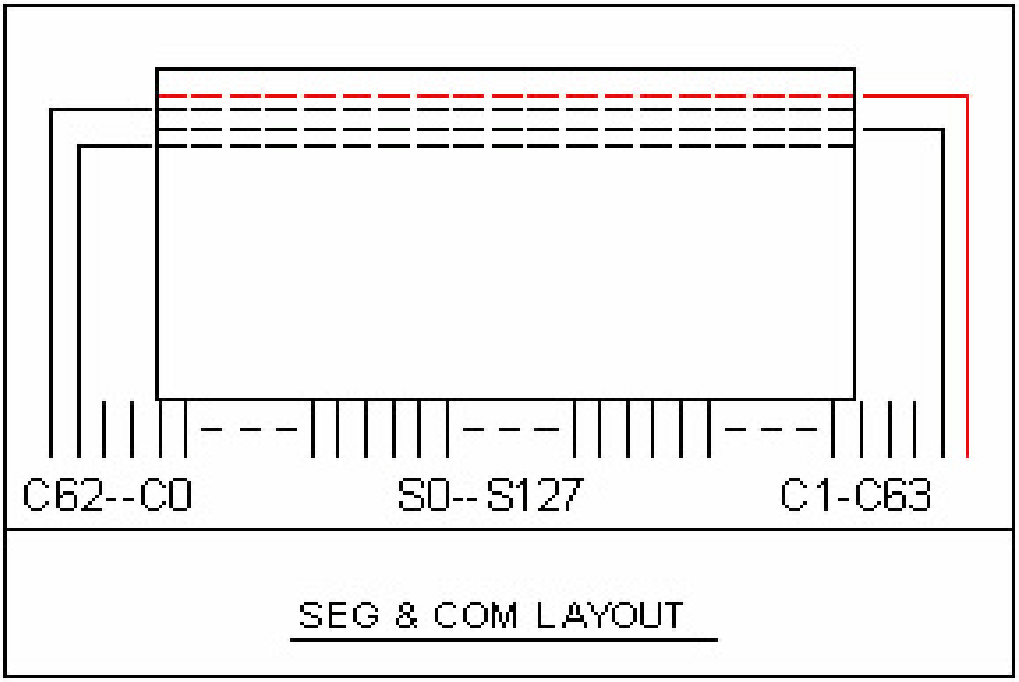
DC-DC Circuit



7.3 COMMAND TABLE

Refer to SSD1303 IC Spec.

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8. RELIABILITY TEST CONDITIONS

No.	Items	Specification	Quantity
1	High temp. (Non-operation)	85°C, 240hrs	3
2	Low temp. (Non-operation)	-40°C, 240hrs	2
3	High temp. (Operation)	70°C, 120hrs	3
4	Low temp. (Operation)	-20°C, 120hrs	2
5	High temp. / High humidity (Non-operation)	85°C, 85%RH, 120hrs	5
6	High temp. / High humidity (Operation)	65°C, 90%RH, 120hrs	5
7	Thermal shock (Non-operation)	-40°C ~85°C (-40°C /30min; transit /3min; 85°C /30min; transit /3min) 1cycle: 66min, 100 cycles	2
8	OLB Peel strength (Non-operation)	500g/cm (Speed~ 50mm/min)	5
9	Vibration	Frequency : 5~50HZ, 0.5G Scan rate : 1 oct/min Time : 2 hrs/axis Test axis : X, Y, Z	1 Carton
10	Drop	Height: 120cm Sequence : 1 angle□3 edges and 6 faces Cycles: 1	1 Carton
11	ESD (Non-operation)	Air discharge model, ±8kV, 10 times	5

Test and measurement conditions

1. All measurements shall not be started until the specimens attain to temperature stability.
2. All-pixels-on is used as operation test pattern.
3. The degradation of Polarizer are ignored for item 1, 5 & 6.

Evaluation criteria

1. The function test is OK.
2. No observable defects.
3. Luminance: > 50% of initial value.
4. Current consumption: within ± 50% of initial value.

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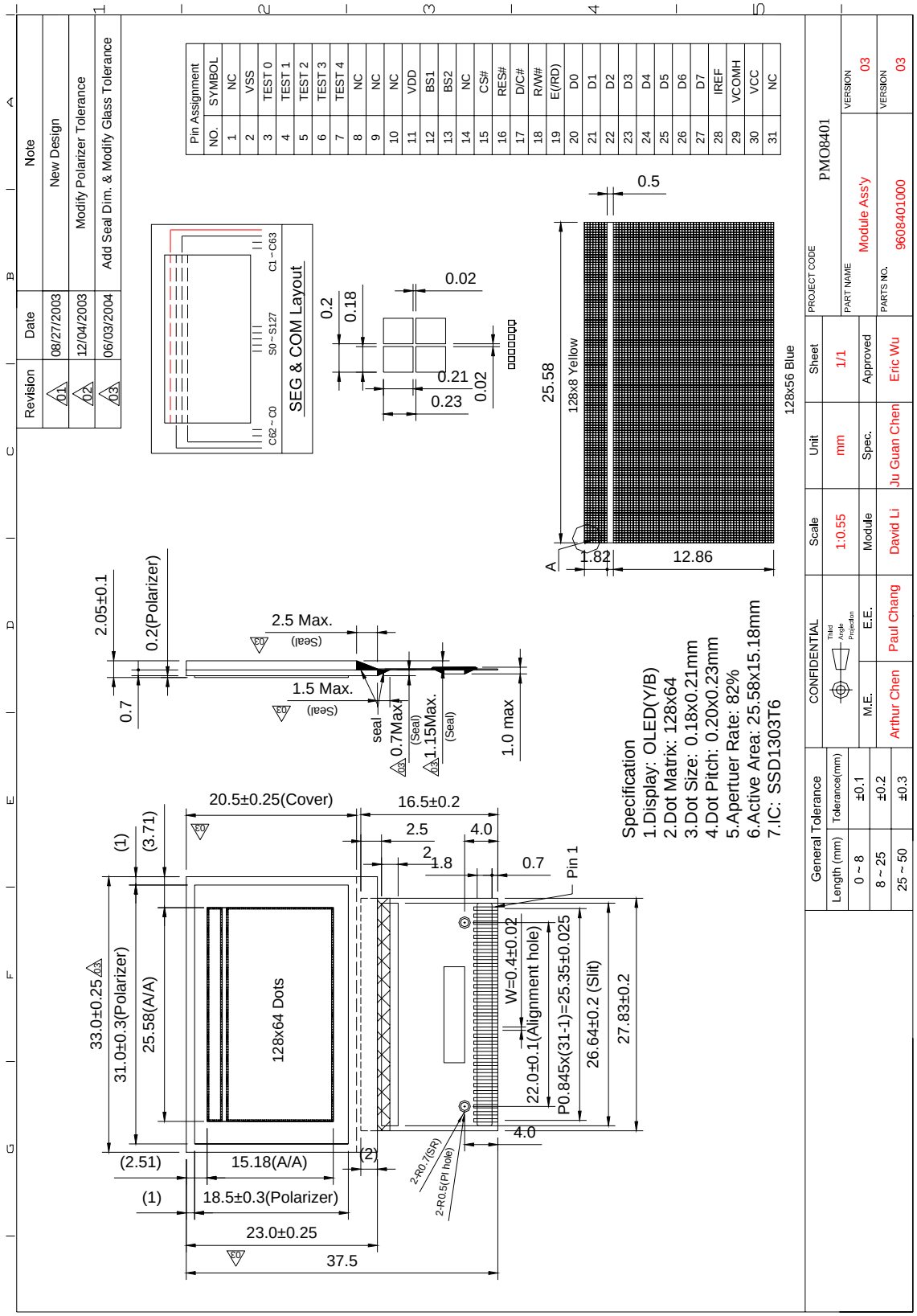
9. EXTERNAL DIMENSION



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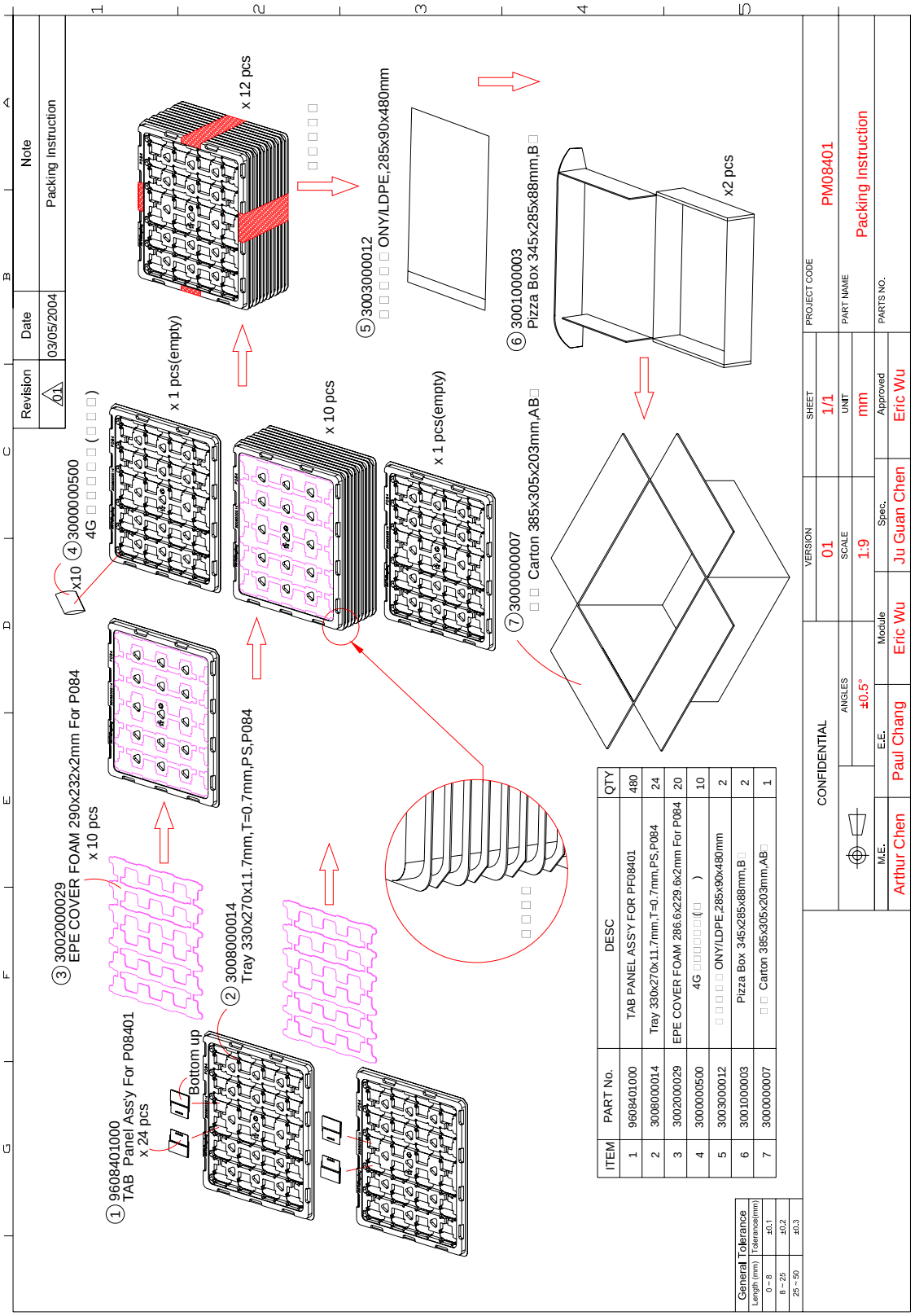
10. PACKING SPECIFICATION



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11. APPENDIXES

APPENDIX 1: DEFINITIONS

A. DEFINITION OF CHROMATICITY COORDINATE

The chromaticity coordinate is defined as the coordinate value on the CIE 1931 color chart for R, G, B, W.

B. DEFINITION OF CONTRAST RATIO

The contrast ratio is defined as the following formula:

$$\text{Contrast Ratio} = \frac{\text{Luminance of all pixels on measurement}}{\text{Luminance of all pixels off measurement}}$$

C. DEFINITION OF RESPONSE TIME

The definition of response time (Tr, Tf) is the time interval from turn on state to turn off state or vice versa, which is shown in Figure 2.

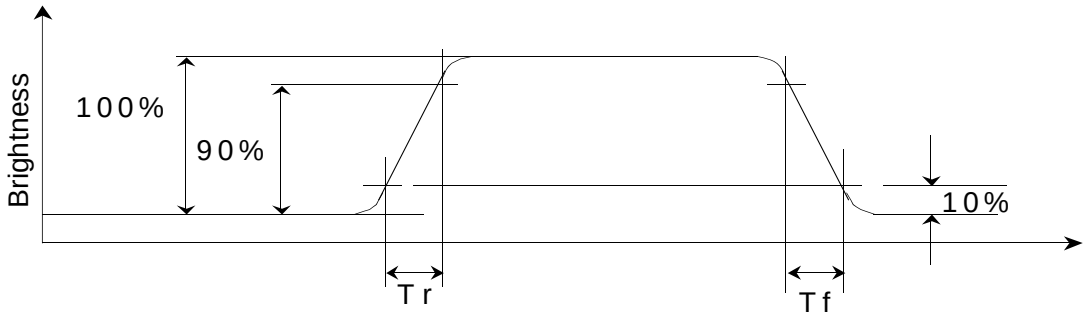

Figure 2: Response time

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D. DEFINITION OF VIEWING ANGLE

The viewing angle is defined as Figure 3.

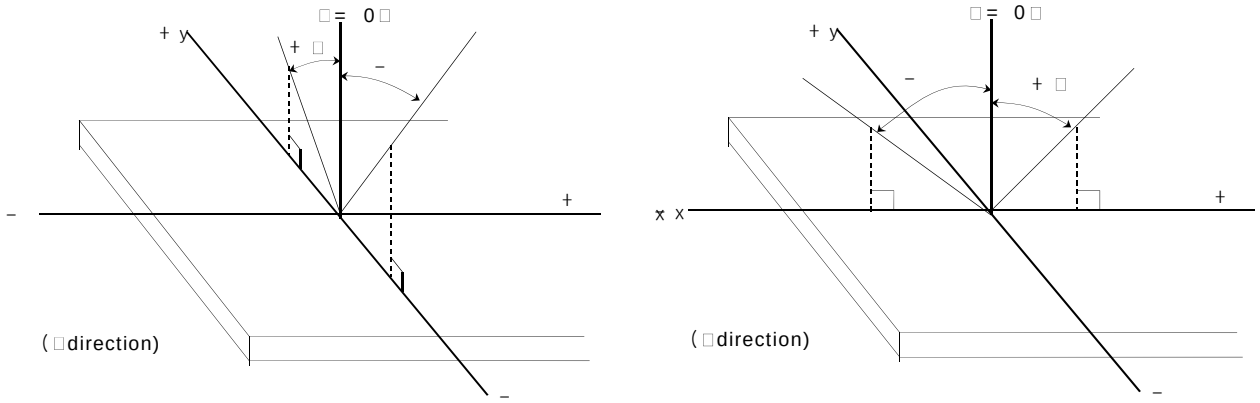

Figure 3: Viewing Angle

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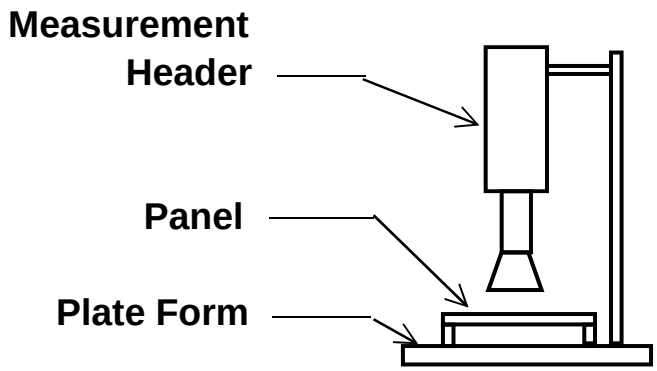
APPENDIX 2: MEASUREMENT APPARATUS

A. LUMINANCE/COLOR COORDINATE

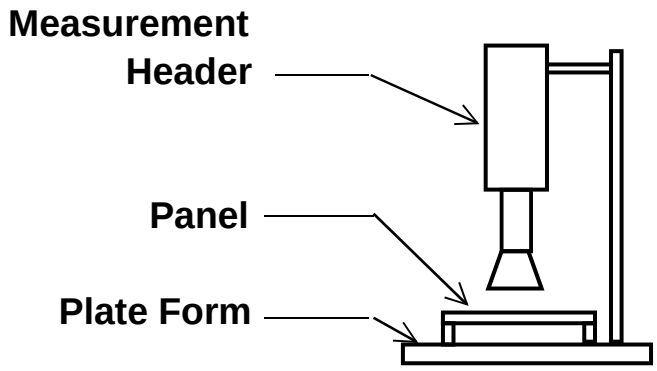
PHOTO RESEARCH PR-705, MINOLTA CS-100



**PR-705 /
MINOLTA CS-100
Color Analyzer**

B. CONTRAST / RESPONSE TIME / VIEW ANGLE

WESTAR CORPORATION FPM-510



**Westar FPM-510
Display Contrast /
Response time /
View angle Analyzer**

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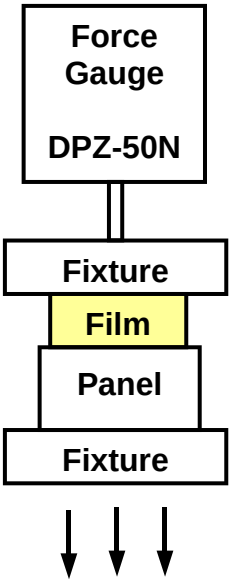
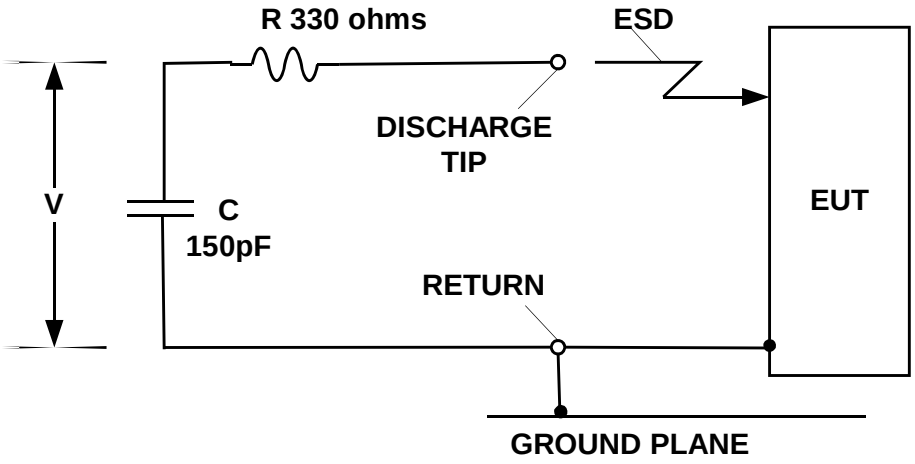
C. PEEL STRENGTH



D. ESD ON AIR DISCHARGE MODE



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APPENDIX 3: PRECAUTIONS

A. RESIDUE IMAGE

Because the pixels are lighted in different time, the luminance of active pixels may reduce or differ from inactive pixels. Therefore, the residue image will occur. To avoid the residue image, every pixel needs to be lighted up uniformly.

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